WHAT IS CLAIMED IS:

1. A blazed grating based electro-optic switching system, comprising:

a fiber optic tap operable to receive an optical signal having header information and payload information and to form a first signal copy comprising at least the header information and a second signal copy comprising at least the payload information;

an electronic processor operable to receive the first signal copy and to perform electronic processing on the header information; and

an array of blazed grating based optical switch elements operable to receive the first and second signal copies and to perform an optical switching operation on the first and second signal copies.

2. The system of Claim 1, wherein each switch element comprises:

a variable blazed grating oriented in a first position and operable to receive a first optical signal and a second optical signal, while the grating remains in a first position the blazed grating operable to reflect the first signal toward a first circulator and to reflect the second signal toward a second circulator, wherein either the first or the second circulator is coupled to an output port and the other is coupled to a drop port;

wherein the variable blazed grating is operable to undergo a selective displacement to a second position, the displacement resulting in a diffraction of a majority of the first input signal toward the second circulator and a diffraction of a majority of the second input signal toward the first circulator.

3. The system of Claim 1, further comprising a delay line operable to receive the second signal copy and to delay transmission of the second signal copy to the array until the second signal portion has been processed by the electronic processor.

4. A logic gate capable of being used in an optical processing device, comprising:

at least a first optical amplifier and a second optical amplifier located approximately symmetrically in a Mach Zehnder Interferometer (MZI), the first optical amplifier operable to receive a first data signal and the second optical amplifier operable to receive a second data signal, wherein the first data signal and the second data signal are received substantially simultaneously;

a light source coupled to the Mach Zehnder Interferometer and operable to generate a clock signal, wherein the clock signal traverses the first optical amplifier in a direction that is counter to a direction that the first data signal traverses the first optical amplifier.

5. The logic gate of Claim 4, wherein the optical processing device is selected from the group consisting of a core-optical data router and an optical regenerator.

6. The logic gate of Claim 4, wherein the logic gate is capable of performing switching operations at 40 Gb/s or more.

7. The logic gate of Claim 4, wherein the first optical amplifier and the second optical amplifier comprise semiconductor optical amplifiers.

8. The logic gate of Claim 4, wherein the first data signal comprises a packet label associated with an optical signal and the second data signal comprises a swapping sequence, and wherein the logic gate is operable to change the packet label associated with the optical signal based on the swapping sequence.

9. The logic gate of Claim 4, wherein the logic gate is selected from the group consisting of an XOR logic gate, an AND logic gate, an inverter, a regenerator, and a buffer gate.

10. The logic gate of Claim 4, wherein at least some of the plurality of optical amplifiers are located on a single semiconductor substrate.

11. The logic gate of Claim 10, wherein the single semiconductor substrate comprises a material selected from the group consisting of silicon, poly-silicon, indium phosphide, and gallium arsenide.

12. The logic gate of Claim 4, wherein at least one of the plurality of optical amplifiers comprises a semiconductor optical amplifier.

13. The logic gate of Claim 12, wherein the at least one semiconductor optical amplifier operates at transparency.

14. The logic gate of Claim 12, wherein the at least one semiconductor optical amplifier is substantially polarization independent.

15. The logic gate of Claim 12, wherein a polarization dependent loss associated with the at least one semiconductor optical amplifier is no more than three (3) dB.

16. The logic gate of Claim 12, wherein a polarization dependent loss associated with the at least one semiconductor optical amplifier is no more than one (1) dB.

17. The logic gate of Claim 12, wherein a polarization dependent loss associated with the at least one semiconductor optical amplifier is no more than one-half (0.5) dB.

18. The logic gate of Claim 12, wherein the semiconductor optical amplifier comprises an InGaAsP semiconductor optical amplifier.

19. The logic gate of Claim 4, wherein the interferometer is capable of 2R regeneration.

20. The logic gate of Claim 4, wherein the interferometer is capable of 3R regeneration.

21. The logic gate of Claim 4, wherein the interferometer is capable of wavelength conversion to reduce contention within a switching element coupled to the logic gate.

22. The logic gate of Claim 4, wherein the light source is selected from the group consisting of a continuous wave light source, a synchronized light source, a tunable light source, a semiconductor laser, a laser diode, and a cladding pumped fiber laser.

23. The logic gate of Claim 4, wherein the light source and at least some of the plurality of optical amplifiers are located on a single semiconductor substrate.

24. The logic gate of Claim 4, wherein the clock signal comprises a wavelength that is substantially similar to a wavelength associated with the first data signal.

25. The logic gate of Claim 4, wherein the clock signal comprises an optical signal wavelength that is different than an optical signal wavelength associated with the first data signal.

26. The logic gate of Claim 4, wherein the first data signal comprises a data format selected from the group consisting of polarization shift keying (PLSK), pulse position modulation (PPM), Generalized Multi-Protocol Label Swapping (GMPLS), Multi-Protocol Label Swapping (MPLS), non-return to zero (NRZ), return to zero (RZ), and differential phase shift key (DPSK).

27. The logic gate of Claim 4, wherein the first data signal comprises at least one packet label and packet data, and wherein the at least one packet label and the packet data are communicated at substantially similar bit rates.

28. A switching element capable of being used in an optical processing device, comprising:

an optical signal separator operable to separate a multiple wavelength optical signal into one or more optical signal wavelengths;

a plurality of semiconductor optical amplifiers located on a single semiconductor substrate, the plurality of semiconductor optical amplifiers operable to perform an optical switching operation on at least one of the optical signal wavelengths; and

a controller operable to generate a control signal that affects the optical switching operation performed by one or more of the plurality of semiconductor optical amplifiers.

29. The switching element of Claim 28, wherein each semiconductor optical amplifier is capable of operating in a gain state and an absorption state.

30. The switching element of Claim 28, wherein the logic gate is capable of performing switching operations at 10 Gb/s or more.

31. The switching element of Claim 28, wherein the logic gate is capable of performing switching operations at 40 Gb/s or more.

32. The switching element of Claim 28, wherein at least two of the plurality of semiconductor optical amplifiers are arranged to form an interferometer.

33. The switching element of Claim 28, wherein the at least one semiconductor optical amplifier operates at transparency.

34. The switching element of Claim 28, wherein the at least one semiconductor optical amplifier is substantially polarization independent.

35. The switching element of Claim 28, wherein a polarization dependent loss associated with the at least one semiconductor optical amplifier is no more than three (3) dB.

36. The logic gate of Claim 28, wherein a polarization dependent loss associated with the at least one semiconductor optical amplifier is no more than one-half (0.5) dB.

37. The switching element of Claim 28, wherein the optical switching operation is selected from the group consisting of adding the at least one optical signal wavelength, dropping the at least one optical signal wavelength, and communicating the at least one optical signal wavelength to an output of the switching element.

38. The switching element of Claim 28, wherein the separator and the plurality of semiconductor optical amplifiers are located on the single semiconductor substrate.

39. The switching element of Claim 28, wherein the combiner and the plurality of semiconductor optical amplifiers are located on the single semiconductor substrate.

40. The switching element of Claim 28, wherein the electronic processor and the plurality of semiconductor optical amplifiers are located on the single semiconductor substrate.

41. The switching element of Claim 28, wherein at least some of the plurality of semiconductor optical amplifiers and the separator are located on a single semiconductor substrate.

42. The switching element of Claim 28, wherein the optical separator is selected from the group consisting of an arrayed waveguide grating, a wavelength grating router, a wavelength division demultiplexer, a power splitter, and one or more bulk gratings.

43. The switching element of Claim 28, wherein the control signal is generated based at least in part on a packet label associated with the at least one optical signal wavelength.

44. A logic gate capable of being used in an optical router, comprising:

a plurality of semiconductor optical amplifiers located in an interferometer, at least some of the plurality of semiconductor optical amplifiers operable to receive at least one data signal, wherein at least one of the plurality of semiconductor optical amplifiers operates at transparency; and

a light source coupled to the plurality of optical amplifiers and operable to generate a clock signal.

45. The logic gate of Claim 44, wherein the at least one semiconductor optical amplifier is substantially polarization independent.

46. The logic gate of Claim 44, wherein a polarization dependent loss associated with the at least one semiconductor optical amplifier is no more than three (3) dB.

47. The logic gate of Claim 44, wherein a polarization dependent loss associated with the at least one semiconductor optical amplifier is no more than one-half (0.5) dB.

48. The logic gate of Claim 44, wherein the interferometer is selected from the group consisting of a Mach Zehnder interferometer, a Michelson interferometer, and a Sagnac interferometer.

49. The logic gate of Claim 44, wherein the light source is selected from the group consisting of a continuous wave light source, a synchronized light source, a tunable light source, a semiconductor laser, a laser diode, and a cladding pumped fiber laser.

50. The logic gate of Claim 44, wherein the at least one clock signal traverses at least one of the plurality of optical amplifiers in a direction that is counter to a direction that the at least one data signal traverses the at least one of the plurality of optical amplifiers.

51. The logic gate of Claim 44, wherein the clock signal comprises a wavelength that is substantially similar to a wavelength associated with the data signal.

52. The logic gate of Claim 44, wherein the clock signal comprises a wavelength that is different than a wavelength associated with the data signal.

53. The logic gate of Claim 44, wherein the clock signal comprises a modulated optical signal wavelength, the modulated optical signal wavelength capable of providing a re-timing function.

54. The logic gate of Claim 44, wherein at least some of the plurality of semiconductor optical amplifiers are located on a single semiconductor substrate.

55. An optical switching system, comprising:

a fiber optic tap operable to receive an optical signal having at least one packet label and packet data and to separate the optical signal into a first signal copy and a second signal copy comprising at least packet label;

a first all-optical processing device operable to receive the second signal copy and to perform optical processing on the at least one packet label; and

a second all-optical processing device operable to receive the first signal copy and the processed second signal copy, and to perform an optical switching operation on the first signal copy;

wherein at least one of the first and second all-optical processing devices comprises a plurality of semiconductor optical amplifiers located approximately symmetrically in an interferometer.

56. The switching system of Claim 55, wherein the interferometer is selected from the group consisting of a Mach Zehnder interferometer, a Michelson interferometer, and a Sagnac interferometer.

57. A regenerative device capable of regenerating one or more optical signals, comprising:

an optical signal separator operable to separate a multiple wavelength optical signal into one or more optical signal wavelengths;

a plurality of semiconductor optical amplifiers located on a single semiconductor substrate, the plurality of semiconductor optical amplifiers collectively operable to perform an optical switching operation on at least one of the plurality of optical signal wavelengths; and

a light source coupled to the plurality of optical amplifiers and operable to generate at least a modulated clock signal.

58. The regenerative device of Claim 57, wherein the light source and the plurality of semiconductor optical amplifiers are located on the single semiconductor substrate.

59. The regenerative device of Claim 57, wherein the optical separator and the plurality of semiconductor optical amplifiers are located on the single semiconductor substrate.

60. The regenerative device of Claim 57, wherein each semiconductor optical amplifier is capable of operating in a gain state and an absorption state.

61. The regenerative device of Claim 57, wherein the logic gate is capable of performing switching operations at 40 Gb/s or more.

62. The regenerative device of Claim 57, herein the at least one semiconductor optical amplifier operates at transparency.

63. The regenerative device of Claim 57, wherein the at least one semiconductor optical amplifier is substantially polarization independent.

64. The regenerative device of Claim 57, wherein a polarization dependent loss associated with the at least one semiconductor optical amplifier is no more than three (3) dB.

65. The regenerative device of Claim 57, wherein the optical switching operation is selected from the group consisting of adding the at least one optical signal wavelength, dropping the at least one optical signal wavelength, and communicating the at least one optical signal wavelength.

66. The regenerative device of Claim 57, wherein the optical separator is selected from the group consisting of an arrayed waveguide grating, a wavelength grating router, a wavelength division demultiplexer, a power splitter, and one or more bulk gratings.

67. The regenerative device of Claim 57, wherein the regenerative device is capable of providing 3R regeneration to at least some of the optical signal wavelengths.

68. The regenerative device of Claim 57, wherein the regenerative device is capable of providing 2R regeneration to at least some of the optical signal wavelengths.

69. The regenerative device of Claim 57, wherein the regenerative device is capable of providing wavelength conversion to at least some of the optical signal wavelengths.

70. The regenerative device of Claim 57, wherein the clock signal traverses at least one of the plurality of optical amplifiers in a direction that is counter to a direction that the at least one data signal traverses the at least one of the plurality of optical amplifiers.

71. The regenerative device of Claim 57, wherein the light source is selected from the group consisting of a continuous wave light source, a synchronized light source, a tunable light source, a semiconductor laser, a laser diode, and a cladding pumped fiber laser.

72. The regenerative device of Claim 57, wherein the light source comprises a plurality of laser diodes, each laser diode capable of generating a modulated clock signal at one or more wavelengths.

73. The regenerative device of Claim 57, further comprising a controller operable to generate a control signal that affects the optical switching operation performed by one or more of the plurality of optical amplifiers.